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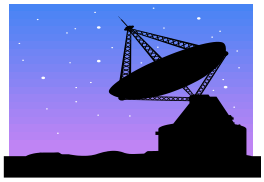
TIDBITS

Tips and Helpful Links

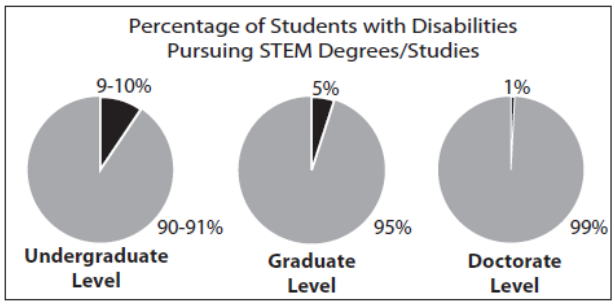
Assessment Division



STEM

and Students with Disabilities

While we know that the jobs of the future are going to require workers with strong STEM backgrounds that enable them to innovate and problem solve, we have failed to prepare students with learning challenges for success in these fields of study. The graph below illustrates the significant under-representation of students with disabilities in STEM fields of study:



(Source: Accommodating Students with Disabilities in STEM, 2012)

Many college freshmen with learning challenges find the barriers in accessing content so discouraging that they drop out in their first year of study. Under-representation of students with disabilities in mathematics is especially problematic since math is a key building block in many other fields within STEM.

Accessibility

Intentional planning is key to providing access for students with disabilities. When lesson plans are developed collaboratively among general education teachers and accommodation specialists, the construct remains intact while the team explores possible variables in presentation. Successful teachers think proactively about effective and efficient lesson sequences, they model and guide students through effective materials, and especially, they monitor learning to modify and accommodate students who may require remediation or enrichment. As teachers observe students at work, noting whether they have difficulties accessing text, storing and remembering critical information, or expressing what they've learned will help guide adaptation choices. In addition, careful review of the materials and methods to be used will reveal possible barriers that need to be addressed. Adaptations need to be accompanied by explicit instruction for their use and in how to perform the work. An effective adaptation should reduce failure or learning difficulties – those that don't should be altered or discontinued.

Planning Lessons

Lesson planning that begins with principals of Universal Design eliminates the need for many accommodations that may be necessary in traditional lecture or text-based lessons as well as in labs. For those students needing scaffolding or accommodation beyond the built-in UD design, a recent article in LD Online suggests the following considerations:

- The use of "smart tools" such as audible lab equipment (thermometers and scales)
- Visual representations using graphing software to display data in various formats
- Graphic organizers with text to speech features for note taking and study tools
- Enlarging, bolding, and color coding text to make important points stand out
- Providing multiple opportunities for learning by incorporating technology such as serious games into lesson plans
- Virtual labs allow students to preview and practice prior to a hands-on lab
- Virtual field trips help make the connections between content and real-world application
- Team projects using WebQuests motivate and engage students in STEM subjects
- Text to speech software and talking calculators to eliminate barriers

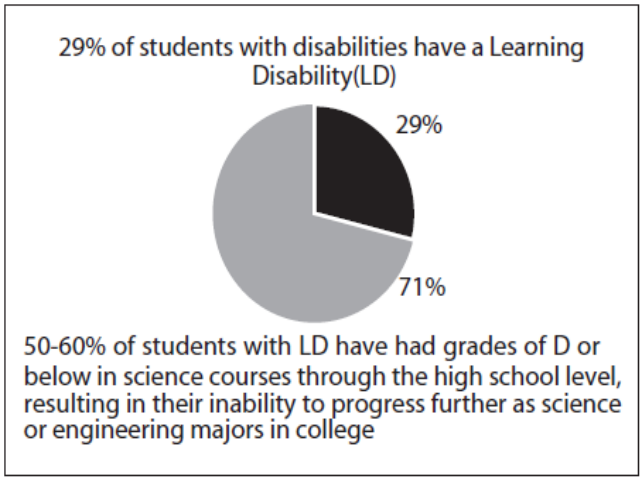
Check out the Next Generation Science Standards at this link:

Science

Scaffolding Instruction

Scaffolding makes content meaningful and accessible to students with special needs. An important consideration when providing scaffolding is understanding that students become dependent on the person who creates them. Scaffolding should simply serve as a temporary bridge to skills development with plans for monitoring effectiveness as well the systematic withdrawal of supports to foster independence. In contrast, adaptations may be of a more permanent nature, such as enlarged print for a student with low vision.

Read more about scaffolding instruction and STEM access here.



(Horn & Berktold, 1999)

Self-Advocacy

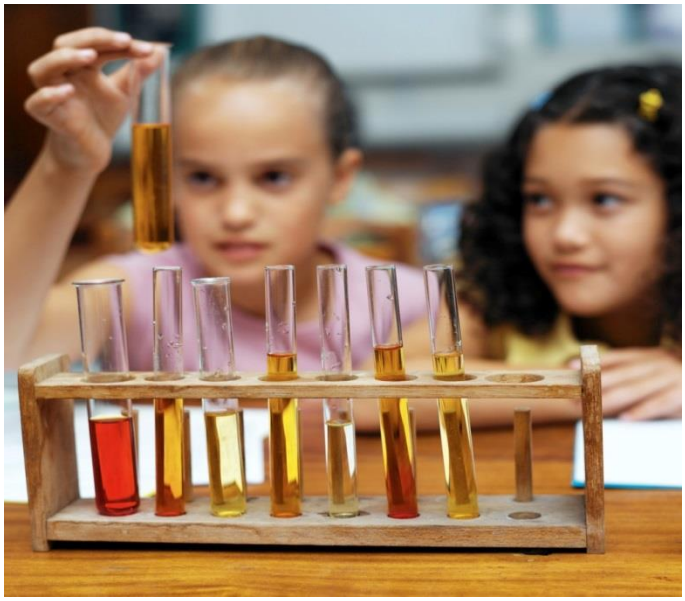
A critical part of becoming an independent learner is developing an awareness of the nature of one's disability and resulting personal needs, then advocating for necessary adaptations and scaffolding that provide access across settings. It is widely assumed that part of what constitutes academic ability at the university level is the ability for self-guided learning and independent inquiry. SWD need to understand the various settings in which they interact daily and what role they play in each. Self-advocacy should develop slowly over the course of childhood. Throughout their school years students need explicit instruction and practice to develop these skills before they move on to college and career. As they mature, SWD need to realize that they are the experts regarding their own needs, and although developing the confidence to speak up may be scary at first, it's vital to having their needs met. By the time they're in high school, students should be able to speak for themselves. Throughout the school years they will go through many trial and error scenarios with equipment, technology, and styles of lesson delivery. Keeping track of effective accommodations will create a "bank" that can serve as a valuable reference as they endeavor to negotiate various settings on their own.

There are programs at various universities throughout the country that reach out to SWD who choose to study in a STEM field. One such program at New Mexico State University provides the means as well as support and encouragement for these students to succeed:

http://www.nmsu.edu/atnmsu/cur/reachthepinnacle.html

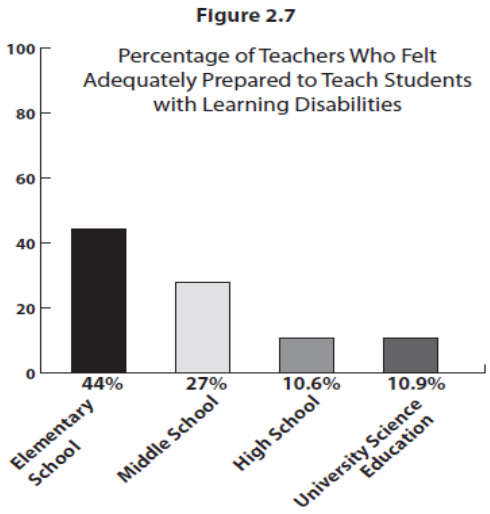
See STEM and People with Disabilities, funded by The National Science Foundation and learn more about preparing high school students with disabilities for STEM college and career work at DO-IT Scholars, a program at the University of Washington.

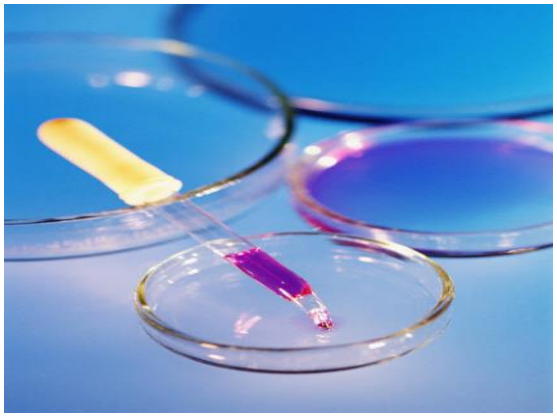
Accommodating Students with Disabilities in STEM is a practical, comprehensive resource which provides practitioners with an array of accommodation options available for use in teaching in the STEM disciplines. It looks at each aspect of STEM and offers suggestions for accessibility as well as pointing out particularly challenging areas in the interface between content and specific disabilities. Information on designing spaces for physical access (including dexterity limitations) as well as current technology and presentation options that alleviate barriers are discussed.



Science

Full inclusion in the sciences for SWD is difficult for a variety of reasons. The "hands-on" nature of instruction such as field experiences, building prototypes, lab experiments, and design present multiple barriers that need to be addressed before the student with challenges can fully participate. Such alternatives as using human assistants or helpers as well as group participation (considered partial participation) are not regarded as viable solutions since participation, not just observing, is considered an integral part of learning in this discipline. The goal of field/lab exercises is to immerse the student in the physical work of science. In addition, research has shown that middle and high school teachers feel unprepared to teach SWD in content area classes. Consequently, studies have found that high school SWD are discouraged from pursuing STEM coursework because of the perceived difficulty in accommodating them. These conditions contribute to the low incidence of SWD enrolled in STEM classes. Providing PD and encouraging collaborative planning with disability specialists will help content area teachers bridge these gaps.





High school math and science teachers can access information here to design more effective instructional approaches for students with disabilities: SciTrain developed a resource database with publications on science and math accommodations.

http://www.catea.gatech.edu/scitrain/accommodating.pdf

Successful inclusion of special needs students in science classes:
http://www.csmd.edu/istem/pdf/Michelle_Shearer_Special_Needs_Students_AP%20Science_Courses.pdf

View students discussing various adaptations that provide access to science labs here.

Visit the Afterschool Alliance for ideas on building STEM skills outside of school hours. Hands-on project-based learning engages students and inspires them to consider careers in STEM fields.

For program summaries and information on the positive impact of STEM-focused clubs and organizations across the United States, visit this outcomes document at Afterschool Alliance.

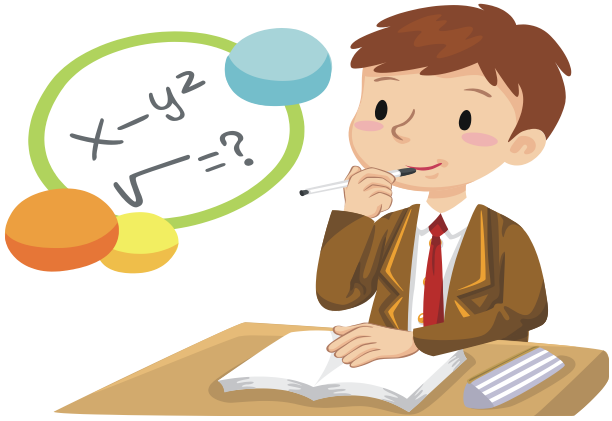
For a list of STEM-related disciplines that are projected to add substantial numbers of new jobs to the economy, visit:

http://en.wikipedia.org/wiki/STEM_fields

Math

The AZ Common Core Math Standards are designed to be fewer and deeper at each grade level. The reasoning behind the design is that students need time and practice to thoroughly explore concepts, making important connections as they construct a solid framework on which to build. While basic reading proficiency is a strong predictor of mathematics achievement, number sense is an even stronger predictor, so providing a solid foundation with numbers and math notation is important for all students. Research indicates that building foundational skills and increasing interest through extensive exposure to STEM fields in elementary school is critical to success in middle school, high school, and beyond.

Problems with processing, memory, and organizational skills inhibit math proficiency for SWD. In addition, the fact that mathematics instruction has become more rigorous earlier in the curriculum has prompted the National Council of Teachers of Mathematics (NCTM), in its Principles and Standards for School Mathematics, to emphasize hands-on learning as a means to help bolster problem-solving and higher-order thinking skills of math learners. Embedding separate algebra programs, such as Algebra Tiles and Hands-On Equations, within the broader math program has been suggested to address the needs of students with below average math abilities.



It's important to make language an essential component of math instruction, especially in real world problem solving. Symbols should be introduced in context so that students understand the need for them. Utilizing tech tools enables movement beyond the computational skills level toward advanced concepts. The CCSS presents a logical, coherent sequence for teaching math concepts that will prove beneficial for all students, and providing flexibility in how students learn material will maximize success.

MathPad, a set of modules with built in accessibility options for students with physical and learning disabilities and PlaneMath, a NASA-sponsored service designed to teach math to students with disabilities are resources worth exploring. The Illuminations website has games and lesson ideas to explore.

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